Space Weather Technical Forecast

Issued on Sunday, 28 April 2024 at 13:09 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: A chance of further M-flares and slight chance of X-flares through the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity is currently Moderate, with a M3.0 flare at 27/2140 UTC from AR3654, along with an earlier M2 flare from the same region at 27/1235 UTC. There remain eight sunspot regions on the visible disc. AR3654, west of centre disc, continues to dominate the flare risk. This region showing further development in its intermediate/trailer portion in recent hours and retaining a delta spot configuration here. AR3658 in the southwest has shown some minor development, with a few small intermediate spots emerging. Remaining sunspot regions are all relatively small, simple and stable, or showing slight decay.

No likely Earth directed CMEs observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE at L1 have shown the declining influence of a likely HSS. Wind speeds initially elevated near 500 km/s, but reduced erratically through the period to current levels around 400km/s. Density has been average or below. The Interplanetary Magnetic Field initially Moderate, peaking round 13nT at 27/1800UTC before declining to become become weak, 5-6 nT. The north-south component, Bz, showed alternating periods of moderately negative and positive, peaks +12 nT and -9 nT, initially, but also reduced from 27/1800UTC to vary weakly. Phi angle was mostly positive (away from the Sun) with some brief negative (toward the Sun) periods. Geomagnetic activity was Quiet to Active (Kp 1 to 4).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels.

High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence mostly steady, and well below the Active threshold, with 1.72e6 integrated pfu observed at 28/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: A chance of M-flares and a slight chance of X-flares maintained though the period, this mainly in association with AR3654.

Solar Wind / Geomagnetic Activity: A CME which originated late on 26 Apr from an area of plage and a filament eruption in the southeast of the disc, could give a glancing blow early on day 3 (30 Apr).

Recent coronal hole HSS influence weakened during the second half of the 27 Apr with conditions currently returning towards background levels. However, further likely weak coronal hole influences possible in the next few days. Later on day 4 (1 May) a more likely connection

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comes from the narrow trans-equatorial coronal hole CH31/-.

Geomagnetic activity is expected to be Quiet to Unsettled for much of the period, but with a slight chance of Active to G1/Minor Storm intervals due to coronal hole or possible glancing CME influences.

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, but with a decreasing slight chance of reaching the S1/Minor Radiation Storm threshold, as the large sunspot cluster which was in the southwest rotates well away from the limb.
High energy electron flux could perhaps increase slightly in the next couple of days as HSS influences wane. However, fairly high confidence that fluence will remain well below the Active (1e8 integrated pfu) threshold.

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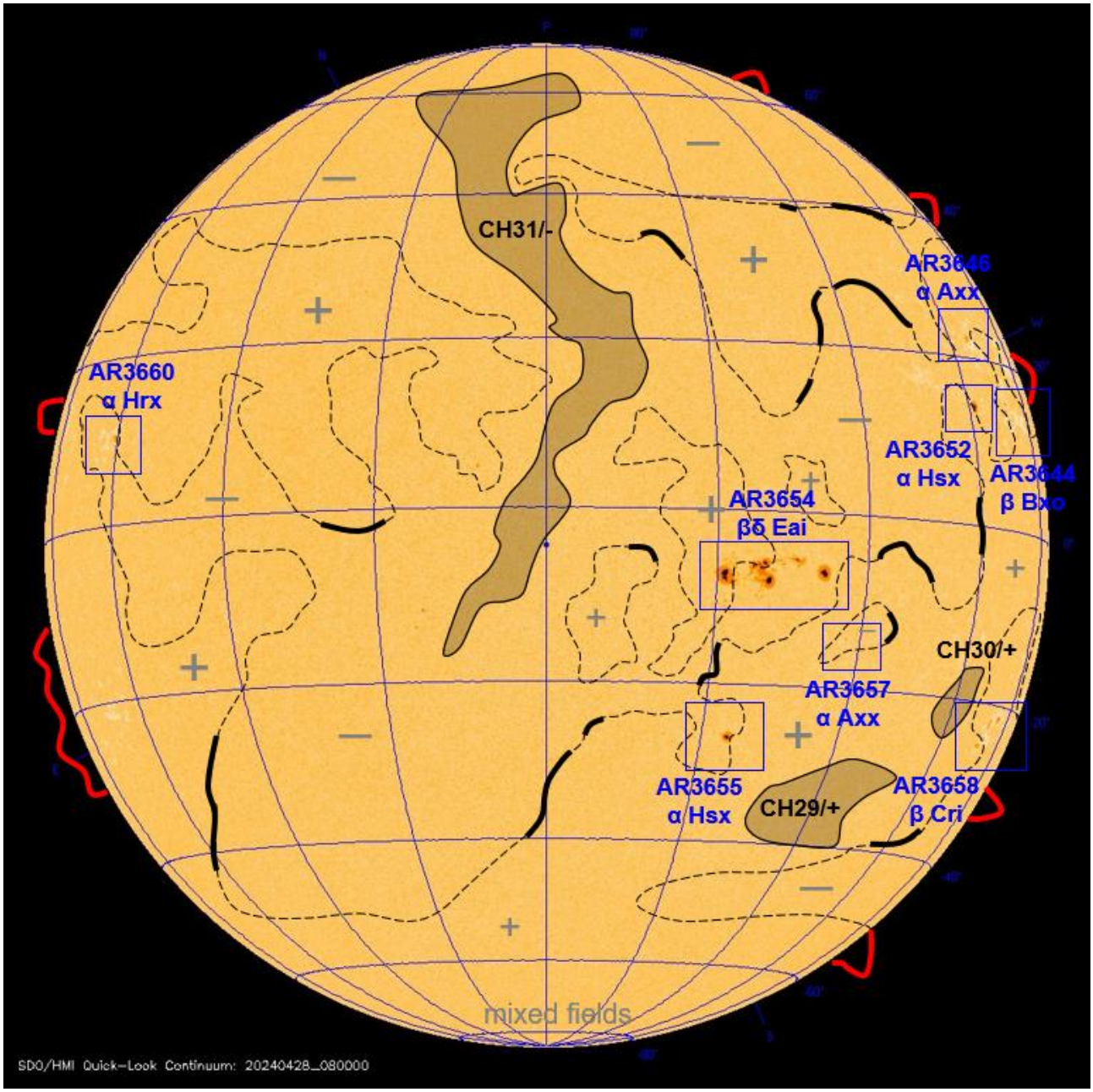
Figure 1. Solar Analysis Valid 28/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

There is currently one CME potentially featuring in the forecast, this starting around 26/1830 UTC and emerged from an area of plage in the southeast of the disc, likely associated with a filament eruption. The resulting CME is modeled as mostly passing behind and below Earth's orbit, but there is a slight chance of a peripheral glancing blow on day 3 (30 Apr).
Recent coronal hole HSS influence, most likely from CH27/+, weakened during the second half of the 27 Apr with conditions currently returning towards background levels. However, further likely weak coronal hole influences from CH30/+ and CH29/+ are possible in the next few days, although these lie progressively further to the south. Later on day 4 (1 May) a more likely connection comes from the narrow trans-equatorial coronal hole CH31/-, which could become geoffective. This is a recurrent feature which gave Unsettled geomagnetic conditions on the last rotation.

Geomagnetic activity is expected to be Quiet to Unsettled for much of the period, but with a slight chance of Active to G1/Minor Storm intervals, mainly on days 1, 3 and 4 due to coronal hole or possible glancing CME influences.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/0402	Partial	Filament	SE	472km/s	30/1200 UTC	Slight glancing blow possible

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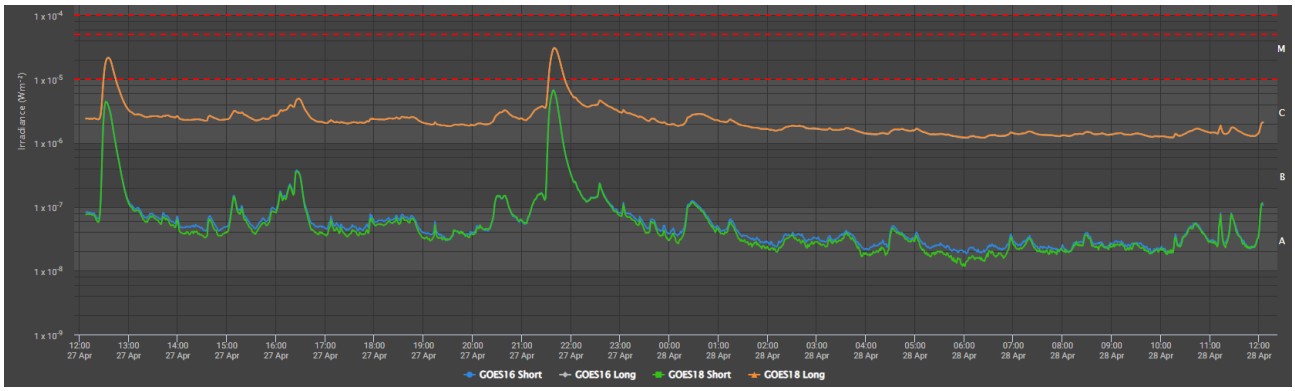
Radio Blackouts - X-Ray Flares:
The large AR3654, west of centre disc, continues to dominate the flare risk on the current visible disk and has been the source of the most recent M-class activity. This region saw some further development in its intermediate/trailer portion over the past 24 hours and retains a delta spot configuration here. All other visible spots generally less significant although some flare potential continues from recently departed active regions around the western limb in the near term, this reduces day 2 (29 Apr) onwards.

No significant returning regions expected through the period with nothing currently signaled in far-side helioseismographs. Brightening on SDO/AIA 94/171 imagery, as well as recent CME activity, does suggest the potential for further regions into the period, this perhaps balancing the loss of regions in the west. Overall, a chance of further M-flares is maintain through the period, with a slight chance of isolated X-flares, this mainly from AR3654.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: Latest 24hr GOES16/18 X-Ray trace



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Solar Radiation Storms - (High Energy Protons):
High energy proton flux (greater than 10MeV) observed at GOES18 has been at background levels, and is most likely to remain that way through this period. However, the cluster of spots which has now rotated over the southwestern limb still has the potential to cause an increase in proton flux until it reaches around 120W, late on day 1 (28 Apr), with a continued slight risk provided by AR3654 as it continues to rotate westwards.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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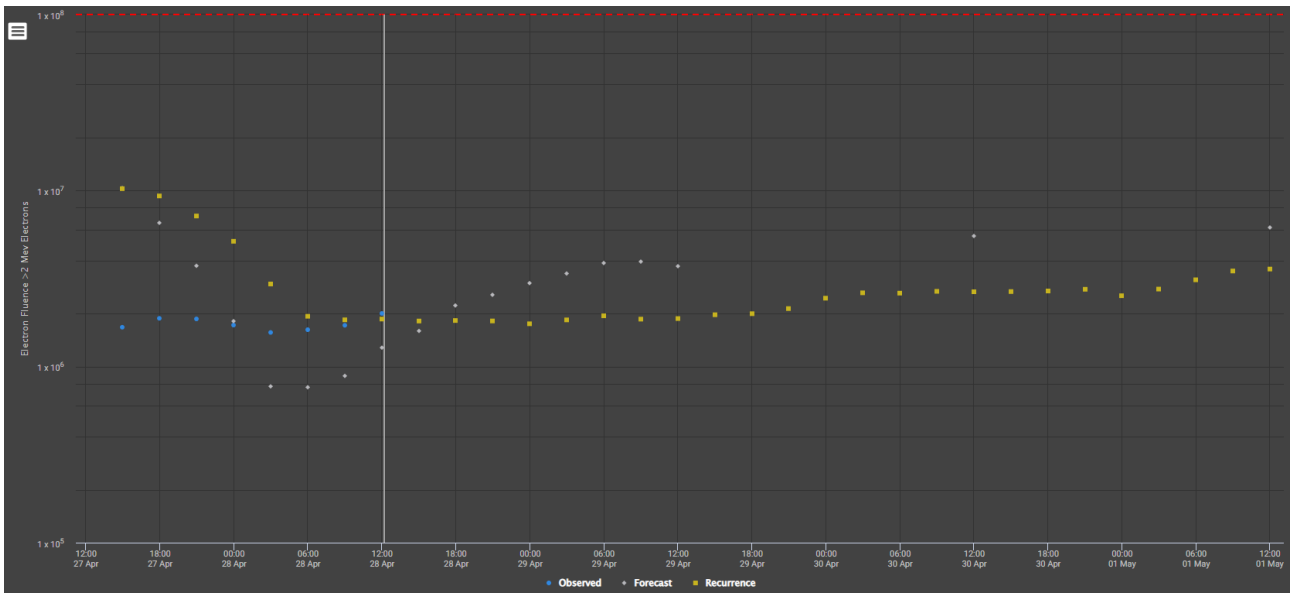
High Energy Electrons Event (≥ 2MeV):
High energy electron flux has been at background to moderate levels. There may be a slight rising trend in flux levels in the next couple of days, as recent coronal hole HSS influences are expected to either remain weak or slowly wane. However, later on day 4 (1 May) CH31/- may become geoeffective, and there is also a low chance of peripheral CME glances on day 3 (30 Apr). Either of these features would tend to reduce electron counts if we saw any significant geomagnetic enhancement.

The 24 hour integrated electron fluence is most likely to remain well below the Active (1e8 integrated pfu) threshold, but perhaps with a slight rising trend as mentioned above. MOSWOC REFM is currently forecasting fluence to remain well below the Active level, and appears good guidance at present.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM output



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